TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during March 1938*—Con.

	Newark, N. J. (14 meters)		Oakland, Calif. (8 meters)		Oklahoma City, Okla. (402 meters)		Omaha, Nebr. (306 meters)		Pearl Harbor, Territory of Hawaii [1] (68 meters)		Pensacola, Fla.[1] (24 meters)		St. Louis, Mo. (170 meters)		Salt Lake City, Utah (1,294 meters)		San Diego, Calif. (15 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (14 meters)		Spokane, Wash. (603 meters)		Washington, D. C. (10 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	266	2.1	149	0.7	183	2.4	76	0.5	47	3.3	118	1.7	222	1.8	163	3.4	96	0.3	110	0.2	158	1.9	168	1.7	269	1.0
500	273	7.3	243	2.1	195	5.3	235	0.9	65	6.2	170	4.1	233	5.7	------	------	260	1.7	252	1.7	193	4.2	------	------	268	7.1
1,000	281	9.1	257	2.3	239	10.5	248	5.3	74	5.4	162	5.1	256	9.2	------	------	283	2.2	274	5.7	197	4.3	212	5.1	285	9.8
1,500	292	10.6	265	1.9	260	10.2	251	6.7	86	2.9	225	6.2	255	10.2	173	5.1	269	4.1	280	7.5	200	3.9	235	6.0	290	11.4
2,000	279	9.1	285	1.6	262	11.8	2o7	7.3	153	0.7	230	5.5	252	9.9	195	4.5	287	5.1	290	9.1	204	4.8	240	6.4	288	13.2
2,500	284	10.7	330	4.2	262	12.3	285	8.8	295	2.8	246	4.7	262	7.0	243	3.3	280	7.5	287	11.1	191	5.2	244	6.4	291	12.8
3,000	282	9.9	313	3.5	282	10.3	286	9.5	295	3.6	256	4.8	276	9.5	258	5.0	287	7.7	290	12.2	198	8.5	252	6.5	299	12.0
4,000	------	------	------	------	272	11.9	253	10.1	282	8.3	------	------	------	------	250	8.1	285	10.2	299	15.6	------	------	263	7.9	------	------
5,000	------	------	------	------	------	------	------	------	------	------	------	------	------	------	249	10.6	289	12 3	------	------	------	------	------	------	------	------

[1] Navy stations.

TABLE 3.—*Maximum free-air wind velocities (meters per second), for different sections of the United States based on pilot-balloon observations during March 1938*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station
Northeast [1]	46.4	NW	2,260	21	Boston	40.4	WSW	3,050	31	Columbus	50.2	NW	9,520	28	Cleveland.
East Central [2]	36.0	WNW	1,360	1	Washington	46.4	WNW	4,680	8	Greensboro	34.6	NW	6,910	28	Cincinnati.
Southeast [3]	34.6	W	2,280	10	Charleston	35.8	W	4,260	10	Charleston	37.8	WNW	8,020	1	Jacksonville.
North Central [4]	32.7	SW	2,230	29	Bismark	36.4	WNW	4,790	13	Sault Ste. Marie	42.0	WNW	5,330	2	Sault Ste. Marie.
Central [5]	37.0	SSW	1,890	30	Moline	35.0	WSW	2,790	30	Moline	42.0	WNW	6,930	23	Moline.
South Central [6]	49.2	WSW	1,730	14	Amarillo	50.2	W	4,090	12	Amarillo	46.3	WSW	6,750	6	Abilene.
Northwest [7]	31.1	WNW	1,310	29	Billings	36.8	NW	4,820	28	Medford	49.0	NW	5,900	28	Medford.
West Central [8]	44.3	SW	1,740	23	Winnemucca	43.5	W	3,580	23	Cheyenne	55.2	NNW	7,880	14	Modena.
Southwest [9]	47.8	W	1,940	19	Havre	70.0	WSW	4,700	4	Albuquerque	59.0	SW	5,000	4	Albuquerque.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

RIVERS AND FLOODS

[River and Flood Division, MERRILL BERNARD in charge]

By BENNETT SWENSON

March 1938 was marked by abundant precipitation, considerably above normal, in practically all regions from the Appalachian Mountains westward, except in portions of the North-Central States, and by temperatures above normal in all sections of the country except the extreme western portion. The heaviest precipitation occurred in portions of California, the lower Ohio Basin, the middle and lower Mississippi Basin, except Louisiana, in Alabama, Mississippi, and portions of Texas, with the most severe floods occurring in these regions.

Atlantic slope drainage.—Floods in this region were light, with no damages of consequence and occurred only at a few scattered points as indicated below.

Mild temperature over the Connecticut River Basin from March 20–25, accompanied by moderate rains, reduced the snow cover existing at high elevations. The high rate of run-off and breaking up of the ice in the northern tributaries resulted in a rise in the Connecticut River, reaching flood stage, however, only at White River Junction, Vt., on March 24.

Other slight overflows occurred as follows: Susquehanna River at Oneonta, N. Y., on the 6th; Tioughnioga River at Whitney Point, N. Y., on the 18th; Saluda River at Pelzer, S. C., on the 17th; and the Savannah River at Clyo, Ga., on the 26th and 27th.

East Gulf of Mexico drainage.—Heavy to excessive rains which fell during the night of March 15–16 over the Conecuh and Pea River basins, caused a rapid rise to above flood stages in both the upper portions of the Conecuh and Pea Rivers on the 16th, and a slower rise in the lower portion of the Conecuh on the 19th. The Choctawhatchee River rose slowly throughout its reach but exceeded flood stage only in the lower portion, on the 21st.

Property losses in this flood are estimated at approximately $75,000.

Heavy rains over the middle and lower Tombigbee River basin on the night of March 15–16 saturated the ground and a series of rises began in that river from Cochrane, Ala., southward. Additional heavy rains on March 19–20 occurred over the Tombigbee and Black Warrior watersheds. As a result of these rains the Black Warrior overflowed its banks at Tuscaloosa, Ala., on March 20, and the Tombigbee exceeded flood stage from Demopolis, Ala., southward. The recurrence of heavy rains on March 23–24 and March 31–April 2 maintained high stages in the Tombigbee so that unusually heavy rains on April 6–9, averaging from 5 inches over the Black Warrior watershed to 13 inches or more in the lower Tombigbee, resulted in floods of considerable proportions.

The report on this flood must necessarily be continued in the next issue of the REVIEW.

The Pearl and Pascagoula River systems were at unseasonably low stages during the first three weeks of March owing to the deficiency of precipitation during December, January, February, and the first three weeks of March. With the occurrence of heavy rainfall on March 19 there began a series of rises, resulting in severe flooding that continued into April. Report on this flood will be made in the April REVIEW.

Upper Mississippi Basin.—Minor floods occurred in the Wisconsin, Illinois, and Meramec rivers during the month. No damage of consequence has been reported from these floods.

Flood stage was exceeded in the Wisconsin River on March 19 at Knowlton, Wis., when a stage of 15.1 feet was reached. The Illinois River has been, near or slightly above bankful stage at some points since January 30, but since the only flood conditions of any consequence occurred after the close of March, a complete report of the Illinois River flood will be made later. The Meramec River reached flood stage at Pacific and Valley Park, Mo., on March 16–17, and was followed by a second overflow on March 31–April 2 when slightly higher stages were reached.

Missouri Basin.—Flood conditions prevailed near the mouth of the Yellowstone River and in the extreme upper Missouri on March 14, and from there moved slowly southward. A large ice gorge formed about 25 miles north of Bismarck on March 18 and 19, backing up considerable water, and caused damage estimated at about $100,000.

The breaking up of the ice gorge on the 19th caused a rise in the stages downstream. Fortunately no heavy rains occurred during the progress of the crest downstream and the only other river gaging station along the Missouri that reported flood stage, in addition to Bismarck, was Nebraska City, Nebr., where a stage of 16.6 feet, flood stage 15 feet, was reached on March 28. Some overflowing of lowlands along the river occurred but owing to the earliness of the season and to precautionary measures very little damage occurred.

A slight overflow occurred in the Floyd and Big Sioux rivers between March 2 and 23, but resulted in no damage of consequence.

Ohio Basin.—The most general flooding in the basin prevailed in the Wabash-White River basin, where a succession of rises occurred and in the Ohio River which was above flood stage from slightly above Evansville, Ind., to the mouth. The flooding in the Wabash River continued into April and a single report for the entire period will be made after the waters recede. The flooding in the Ohio was light and the damage was negligible.

Other light floods in the basin occurred at scattered points as shown in the table below, but were of little consequence.

White Basin.—A flood in the White River began on March 29 and continued into April. The damages in this flood approximate $17,000.

Arkansas Basin.—Floods in the Basin during the closing days of the month and the first three days of April were light and were limited to the North Canadian River in the vicinity of Oklahoma City, Okla., the Poteau and Petit Jean Rivers, and to the Arkansas River near the Arkansas-Oklahoma border. The only losses reported were in the Arkansas River and are estimated at about $6,500.

Red Basin.—The overflow in the Red River that began about February 18 in the upper portion, continued in the lower reaches until the third week in March. Losses from the high water were of a minor nature and levees were not taxed at any point below Shreveport, La. Backwater over the lowlands in the vicinity of Coushatta and Colfax, La., caused the evacuation of about 200 families. The evacuation was orderly, however, and there was little loss, and no crop damage occurred.

Heavy rains over the upper Red Basin on March 28–29 produced another rise in that river but as the flooding continued into April a report will be given in the next issue of the REVIEW.

Lower Mississippi Basin.—Heavy rainfall over the upper St. Francis Basin on March 14–15 caused moderate flooding. On March 29 heavy rainfall again occurred over the basin resulting in a second flood which was in progress at the close of the month.

The Tallahatchie River, which has been above flood stage at Swan Lake, Miss., since January 28, continued above flood stage throughout the month.

West Gulf of Mexico.—Floods in this area were confined largely to the Trinity River and consisted of two floods, one that began in the upper portion in February and reached the lower reaches the first part of March, and the other beginning in the upper portion near the close of the month. The damages in the second flood are estimated at about $50,000, in the Trinity River above Long Lake, Tex.

Colorado Basin.—Heavy general rains from February 27 to March 4 resulted in severe floods in the Verde, Salt, and Gila rivers, in Oak Creek, and several other small creeks and washes in Arizona. The total losses over the state from these floods are estimated at approximately $200,000.

Pacific slope drainage.—Unusually heavy rainfall occurred over southern California during the 5-day period from February 27 to March 3, exceeding all records over a large area, and resulting in destructive floods. A report on these floods will appear in the next issue of the *Review.*

Considerable flooding in the Kings, Kaweah, and Tula rivers in California during March resulted in losses estimated at more than $800,000.

The third major flood of the season occurred in the Sacramento Basin during March. The outstanding feature of this flood was the serious condition in the lower San Joaquin River. At Lathrop, Calif., the water was continuously above flood stage for 20 days, from March 7 to 26.

Continued high water in much of the Sacramento Valley caused heavy seepage through the levees generally. Considerable land was overflowed and resulted in damage estimated at more than $2,000,000.

A light flood occurred in the Willamette River Basin from March 17 to 25 resulting in a loss of approximately $9,000.

Table of flood stages during March 1938

[All dates in March unless otherwise indicated]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ST. LAWRENCE DRAINAGE					
Lake Huron					
	Feet			*Feet*	
Flint: Columbiaville, Mich	8	19	20	8.4	19
Lake Erie					
St. Marys: Decatur, Ind	13	15	20	17.5	18
		23	24	14.4	23
		31	(r)		
ATLANTIC SLOPE DRAINAGE					
Connecticut: White River Junction, Vt	18	24	24	18.0	24
Tioughnioga: Whitney Point, N. Y	12	18	18	12.2	18
Susquehanna: Oneonta, N. Y	12	6	6	13.0	6
Saluda: Pelzer, S. C	6	17	18	6.7	17
Savannah: Clyo, Ga	11	26	27	11.0	26, 27

See footnotes at end of table.

Table of flood stages during March 1938—Continued

River and station	Flood stage	Above flood stages—dates From—	Above flood stages—dates To—	Crest Stage	Crest Date
EAST GULF OF MEXICO DRAINAGE					
Apalachicola: Blountstown, Fla	15	20	20	15.0	20
Pea: Elba, Ala	30	17	17	35.0	17
Choctawhatchee: Caryville, Fla	12	21	24	13.0	22
Conecuh:					
River Falls, Ala	35	16	20	44.2	16
Brewton, Ala	17	18	24	20.7	21
Etowah: Cartersville, Ga	18	20	20	19.2	20
Cahaba: Centerville, Ala	23	20	21	25.4	20
		23	24	27.1	24
Black Warrior: Lock No. 10, Tuscaloosa, Ala	46	20	[2] 25	51.4	21
				53.0	24
Tombigbee:					
Gainesville, Ala	36	24	(1)	41.0	27
Lock No. 4, Demopolis, Ala	39	20	(1)	53.4	29, 30
Lock No. 3, Ala	33	15	(1)	----	----
Lock No. 2, Ala	46	21	(1)	----	----
Lock No. 1, Ala	31	20	(1)	----	----
Pearl:					
Edinburg, Miss	20	23	30	23.7	26
Jackson, Miss	18	20	(1)	----	----
Pearl River, La	12	(3)	5	13.5	Feb. 28, Mar. 1
		27	(1)	13.0	28, 29
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Wisconsin: Knowlton, Wis	12	19	24	15.1	19
Illinois:					
Havana, Ill	14	(3)	5	(4)	----
		24	(1)	15.6	Apr. 1, 2
Beardstown, Ill	14	(3)	2	14.0	Feb. 28–Mar. 2
		24	(1)	----	----
Meramec:					
Sullivan, Mo	11	31	Apr. 1	12.6	31
Pacific, Mo	11	16	16	12.2	16
		31	(1)	15.0	Apr. 1
Valley Park, Mo	14	16	17	15.7	17
		31	Apr. 3	18.9	Apr. 1, 2
Missouri Basin					
Big Sioux: Akron, Iowa	12	4	5	12.9	5
		12	23	17.2	18
Floyd: James, Iowa	15	2	[3] 13	16.7	2–3
Missouri:					
Bismarck, N. Dak	19	19	20	20.5	19
Nebraska City, Nebr	15	25	29	16.6	28
Ohio Basin					
Allegheny:					
Lock No. 8, Mosgrove, Pa	24	7	7	24.0	7
Lock No. 5, Schenley, Pa	24	7	7	24.0	7
Walhonding: Walhonding, Ohio	8	15	17	10.0	15
Tuscarawas: Coshocton, Ohio	11	15	20	13.4	18
Muskingum: Lock No. 7, McConnelsville, Ohio	22	17	17	22.2	17
Scioto:					
La Rue, Ohio	11	6	6	11.2	6
		15	17	12.1	15
Prospect, Ohio	10	16	18	10.8	17
Circleville, Ohio	14	17	18	15.0	17
Chillicothe, Ohio	16	16	18	17.6	16
Miami: Middletown, Ohio	15	16	16	15.0	16
Green: Lock No. 2, Rumsey, Ky	34	16	22	35.7	19–20
West Fork of White:					
Anderson, Ind	8	6	(1)	13.8	31
Elliston, Ind	18	7	10	21.0	7
		14	22	25.7	17
		[3] 25	(1)	23.4	28
Edwardsport, Ind	12	(3)	1	(4)	----
		6	(1)	19.0	18–20
East Fork of White:					
Seymour, Ind	14	15	19	17.5	17
		27	27	14.1	27
Williams, Ind	10	20	21	11.0	20, 21
White:					
Petersburg, Ind	16	(3)	1	(4)	----
		10	13	16.7	12
		14	(1)	22.6	21–23
Hazleton, Ind	16	10	(1)	23.7	23
Wabash:					
Bluffton, Ind	10	16	19	11.0	18
		31	(1)	----	----
Wabash, Ind	17	16	17	17.6	17
La Fayette, Ind	11	16	21	18.8	18
		25	26	11.8	26
Covington, Ind	16	17	22	22.5	19
		26	27	16.0	26, 27
Terre Haute, Ind	14	17	29	17.5	22
		30	(1)	----	----
Vincennes, Ind	14	19	(1)	15.7	27
Mount Carmel, Ill	19	19	(1)	21.65	23
New Harmony, Ind	15	20	(1)	17.2	26, 27
Cumberland: Celina, Tenn	28	6	8	30.4	6
French Broad: Oldtown (near Newport), Tenn	6	10	10	7.6	10
Ohio:					
Dam No. 47, Newburgh, Ind	38	17	25	39.5	21, 22
Evansville, Ind	35	17	26	37.3	22
Dam No. 48, Cypress, Ind	38	20	24	38.5	22
Mount Vernon, Ind	35	18	27	36.8	23, 24

Table of flood stages during March 1938—Continued

River and station	Flood stage	Above flood stages—dates From—	Above flood stages—dates To—	Crest Stage	Crest Date
MISSISSIPPI SYSTEM—continued					
Ohio Basin—Continued					
Ohio—Continued.					
Dam No. 49, Uniontown, Ky	37	20	28	38.5	24
Shawneetown, Ill	33	14	Apr. 7	38.2	24, 25
				37.2	Apr. 4
Dam No. 50, Fords Ferry, Ky	34	13	Apr. 8	40.0	24, 25
Dam No. 52, Brookport, Ill	37	18	20	37.3	19
		31	(1)	----	----
Dam No. 53, Grand Chain, Ill	42	17	21	42.7	19, 20
		30	(1)	----	----
		16	22	41.1	19
Cairo, Ill	40	27	27	40.0	27
		30	(1)	----	----
White Basin					
Current: Doniphan, Mo	10	29	31	10.6	30
Black:					
Poplar Bluff, Mo	14	30	Apr. 2	15.8	31
Black Rock, Ark	14	(3)	10	(4)	----
		29	(1)	25.1	31
White:					
Calico Rock, Ark	18	29	31	20.9	29
Batesville, Ark	23	29	Apr. 2	31.1	30
Newport, Ark	26	31	(1)	----	----
Arkansas Basin					
North Canadian:					
Yukon, Okla	8	28	28	8.0	28
(East) Oklahoma City, Okla	14	28	28	14.7	28
Poteau: Poteau, Okla	21	29	Apr. 1	27.7	31
Petit Jean: Danville, Ark	20	29	Apr. 2	23.0	31
Arkansas:					
Fort Smith, Ark	22	30	Apr. 2	25.1	31
Van Buren, Ark	22	30	Apr. 3	25.4	31
Red Basin					
Little Missouri: Boughton, Ark	20	30	31	22.0	30
Ouachita:					
Arkadelphia, Ark	17	29	Apr. 1	22.7	29
Monroe, La	40	5	14	40.6	10
Little: Whitecliffs, Ark	25	31	(1)	25.3	31
Sulphur:					
Ringo Crossing, Tex	20	10	10	21.9	10
		27	(1)	26.1	29
Naples, Tex	22	30	(1)	----	----
Red:					
Index, Ark	25	31	(1)	----	----
Fulton, Ark	25	(3)	3	(4)	----
		31	(1)	----	----
Grand Ecore, La	33	Feb. 24	10	38.2	4
Alexandria, La	32	Feb. 22	16	39.8	8
Lower Mississippi Basin					
Big Lake Outlet: Manila, Ark	10	(3)	(1)	(4)	----
St. Francis:					
Fisk, Mo	20	16	20	23.2	18
		30	(1)	----	----
St. Francis, Ark	18	(3)	5	(4)	----
		21	28	19.8	23
Tallahatchie: Swan Lake, Miss	26	(3)	(1)	(4)	----
WEST GULF OF MEXICO DRAINAGE					
Elm Fork: Carrollton, Tex	6	28	(1)	12.4	29
Trinity:					
Dallas, Tex	28	28	(1)	38.8	30
Trinidad, Tex	28	29	(1)	34.8	31
Long Lake, Tex	40	(3)	8	(4)	----
Liberty, Tex	24	2	18	26.5	12
PACIFIC SLOPE DRAINAGE					
San Joaquin Basin					
San Joaquin: Lathrop, Calif	17	7	26	20.9	16
Sacramento Basin					
Sacramento:					
Red Bluff, Calif	23	17	17	23.0	17
		20	20	23.5	20
		23	24	27.6	24
Knights Landing, Calif	30	18	29	31.3	26
Columbia Basin					
Coast Fork: Saginaw, Oreg	9	19	19	11.7	19
McKenzie: Leaburg, Oreg	12	18	19	13.6	18
Santiam: Jefferson, Oreg	10	18	19	12.5	19
Willamette:					
Eugene, Oreg	12	19	19	13.2	19
Harrisburg, Oreg	10	17	[7] 21	14.0	19
		23	24	10.2	23
Albany, Oreg	20	20	21	22.5	20
Oregon City, Oreg	12	20	23	13.1	21

[1] Continued at end of month.
[2] Fell slightly below flood stage on the 23d.
[3] Continued from previous month.
[4] Crest occurred in February.
[5] Fell slightly below flood stage on the 11th.
[6] Fell slightly below flood stage on the 30th.
[7] Fell slightly below flood stage on the 18th.